National Renewable Energy Laboratory
Innovation for Our Energy Future

Multi-Megawatt Turbine Installation at the NWTC

Generating 20 percent of the nation's electricity from clean wind resources will require more and bigger wind turbines. The National Renewable Energy Laboratory (NREL) is installing two large wind turbines at the National Wind Technology Center (NWTC) to examine some of the industry's largest machines and address challenges to rapidly expanding wind energy.

GE 1.5 MW Turbine

Quick Facts

NREL engineers are installing the two largest turbines ever erected at the laboratory – a 1.5 MW turbine manufactured by General Electric and a 2.3 MW turbine from Siemens Power Generation.

Both turbines will be assembled during late August and early September 2009 on the NWTC's eastern perimeter for commissioning and operations by early October 2009. They will operate for years under close observation and with elaborate instrumentation. With data from these experiments, researchers will be working with the wind industry to increase turbine performance, improve durability and decrease loads.

The Department of Energy (DOE) purchased the 1.5 MW GE turbine for installation at the NWTC to use for ongoing wind energy research and development activities.

The Siemens 2.3 MW turbine is being installed as part of a cooperative research and development agreement with Siemens Power Generation for aerodynamics testing, structure and reliability testing and meteorological analysis.

Turbine Specifications

DOE 1.5 MW Turbine

Model	GE 1.5SLE
Production (NWTC Site)	1,600 MWh/y
Production (Typical Site)	4,600 MWh/y
Homes Powered (Typical Site)	410
Tower Height	80 m / 262.5 ft
Rotor Diameter	77 m / 252.6 ft
Swept Area	4.6k m^2 / 50.1k ft^2
Total Height	119 m / 388.8 ft
Met Tower Height	134.1 m / 440 ft

Siemens 2.3 MW Turbine

Model	Siemens 2.3-101
Production (NWTC Site)	2,800 MWh/y
Production (Typical Site)	7,050 MWh/y
Homes Powered (Typical Site)	630
Tower Height	80 m / 262.5 ft
Rotor Diameter	101 m / 331.4 ft
Swept Area	8k m^2 / 86.2 ft^2
Total Height	131 m / 428.1ft
Met Tower Height	134.1 m / 440 ft

Research and Development Objectives

The installation of the DOE GE 1.5MW turbine will allow for NWTC and industry researchers to better study a widely used turbine with the goal of improving its performance and advancing its design. Proposed testing includes gearbox condition monitoring and micro-climate influence on performance and loads.

The Siemens 2.3 MW turbine is among the largest land-based turbines deployed and the primary objective is to better understand the aerodynamics of these new, larger machines. Proposed testing includes: structural and performance testing; modal, acoustics and power quality testing; and aerodynamic testing and turbine performance enhancements.

NREL researchers are equally interested in what is required beneath the ground to support larger wind turbines, which can weigh 400 to 800 tons. NREL and Renewable Energy Systems Americas have entered into a cooperative research and development agreement to study the design and performance of turbine foundations to increase the reliability of non-turbine components and reduce the overall cost of wind-generated power.

After the two new turbines are operating, NWTC engineers will erect two new meteorological towers to the west of the turbines. Each tower will feature more than 60 instruments to collect the most advanced data available on wind, temperature, dew point, precipitation and other weather features that can influence the performance and lifespan of a wind turbine.

Siemens 2.3 MW Turbine

Energy Generation at the NWTC

The new turbines at the NWTC also allow NREL to take a significant step forward in generating its own clean electricity and meeting the laboratory's aggressive sustainability goals and reduce greenhouse gas emissions for its expanding research campus and support facilities. The new turbines are expected to generate twice as much energy as the NWTC uses.

The Department of Energy (DOE), NREL and Xcel Energy are working to define an agreement that will allow surplus energy to be exported and sold to the local utility grid.

Wildlife Considerations

In 2002, NREL conducted a site-wide Environmental Assessment (EA) of the National Wind Technology Center site to determine the potential environmental impacts of future development at the site, including the potential future installation of as many as three new large (multi-megawatt) wind turbines and associated facilities. The EA included a detailed assessment of all biological resources using the site and how those resources might be impacted by future development. A Finding of No Significant Impact (FONSI) was issued after this assessment, permitting this specific type of development at the NWTC to proceed in the future.

NREL is developing a plan to evaluate avian use of the site and implement best management practices to avoid, minimize or mitigate impacts on birds. NREL is in the process of negotiating a subcontract to review existing information and reports related to this installation and develop a plan for monitoring, reporting and analyzing all future interactions with wildlife on the NWTC site related to the operation of these turbines.

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